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Name of Principal Author and all other author(s): Chris K. Burns, Robert H. Vasse, Ronald S. Saylor, Charles E. Derrick

Principal Author's Organization and address:
SAIC, Contractor
U.S. Army AMRDEC
Redstone Arsenal, AL 35898-5000
256-876-4502
Chris.K.Burns@us.army.mil

Phone:256-876-4502

Fax: 256-876-4529

Email:Chris.K.Burns@us.army.mil

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Representation of Consumption Based Logistics in an Engagement Level Warfighting Simulation

June 23, 2005

Overview

- Motivation for model
  - Engagement models
  - Simulation Overview
  - Experiment Overview
- Details of model
  - Internal functionality
  - Study specific models
- The analysis
- Possible extensions

Engagement Models

- What is an engagement model?
  - Algorithms for all critical representations
  - High Fidelity Algorithms where necessary
- Key concepts
  - Predictive performance of concept systems
  - Represent changes in performance details
  - Scrutinize each individual few-on-few engagement

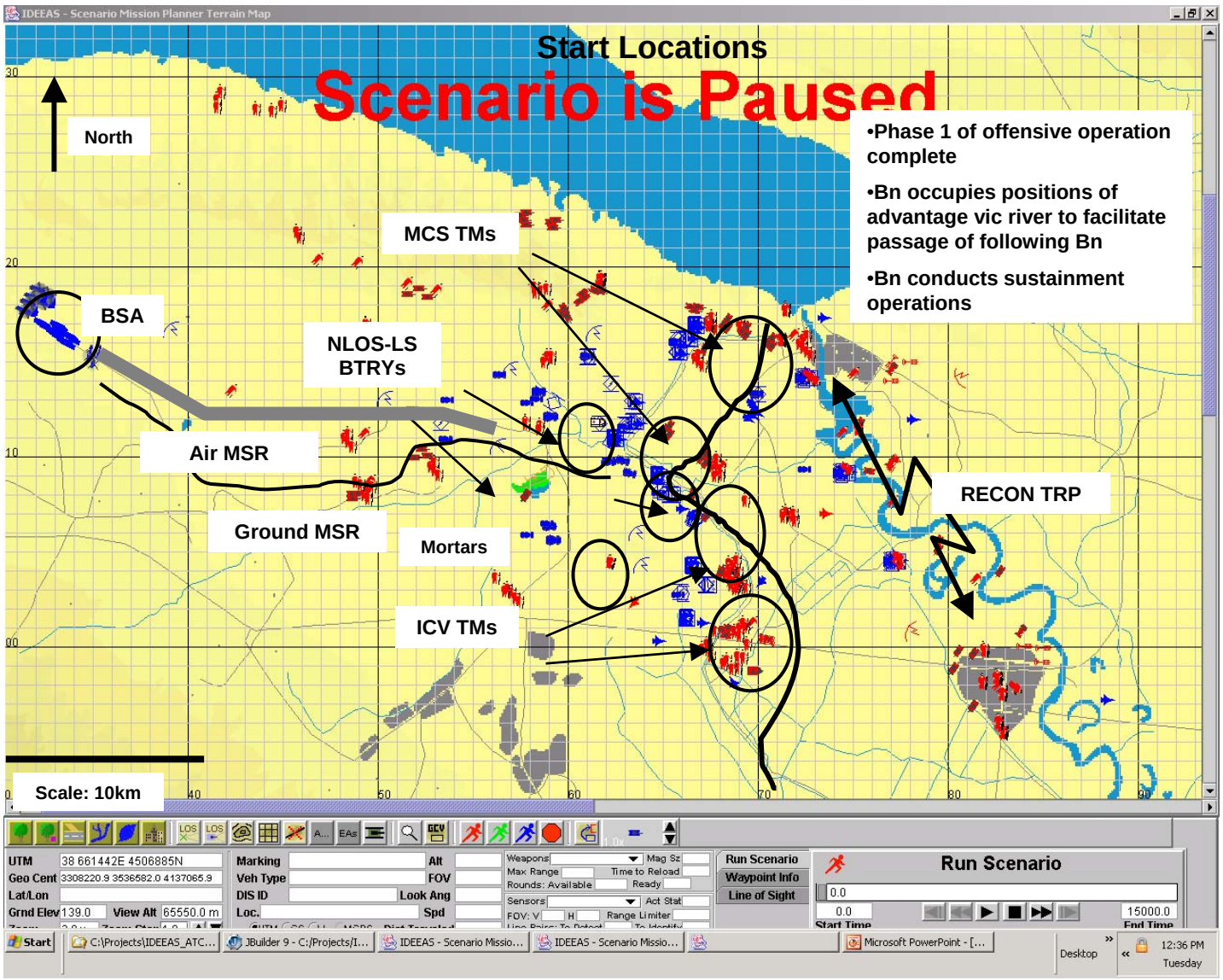
Simulation Overview

- IDEEAS – Interactive Distributed Engineering Evaluation and Analysis Simulation
  - Deterministic models
  - Entity level
  - Repeatable
  - Monte Carlo Support
  - Dynamic Output support

Experiment Overview

- Examine effects of conceptual AANT/WAASP logistic system on Combined Arms Battalion (+) Sustainment Operations
  - Base Case: FTTS Trucks – 16 Tons ea.
  - Alternative: AANT/WAASP –1 Ton ea.
- Analyze differences in results
  - Operating in identical vignette
    - Trucks only
    - Unmanned systems only
    - Combination

Vignette Details

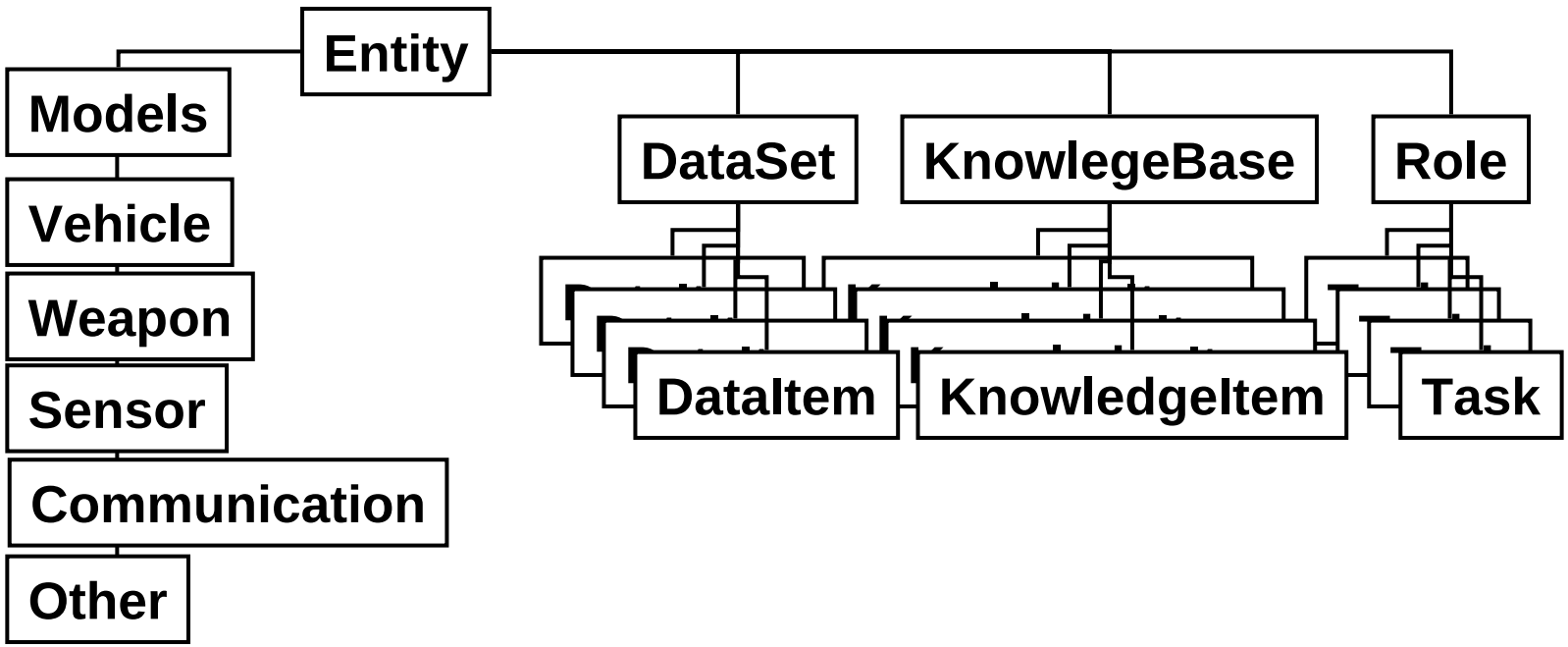


Simulation Details

- Explicit Entity level modeling
  - Ammo consumption by weapon type
  - Fuel by vehicle type
  - Commander behavior at Platoon, Company, and BSA levels
  - Communication between vehicles
  - Supply loads and transfer rates

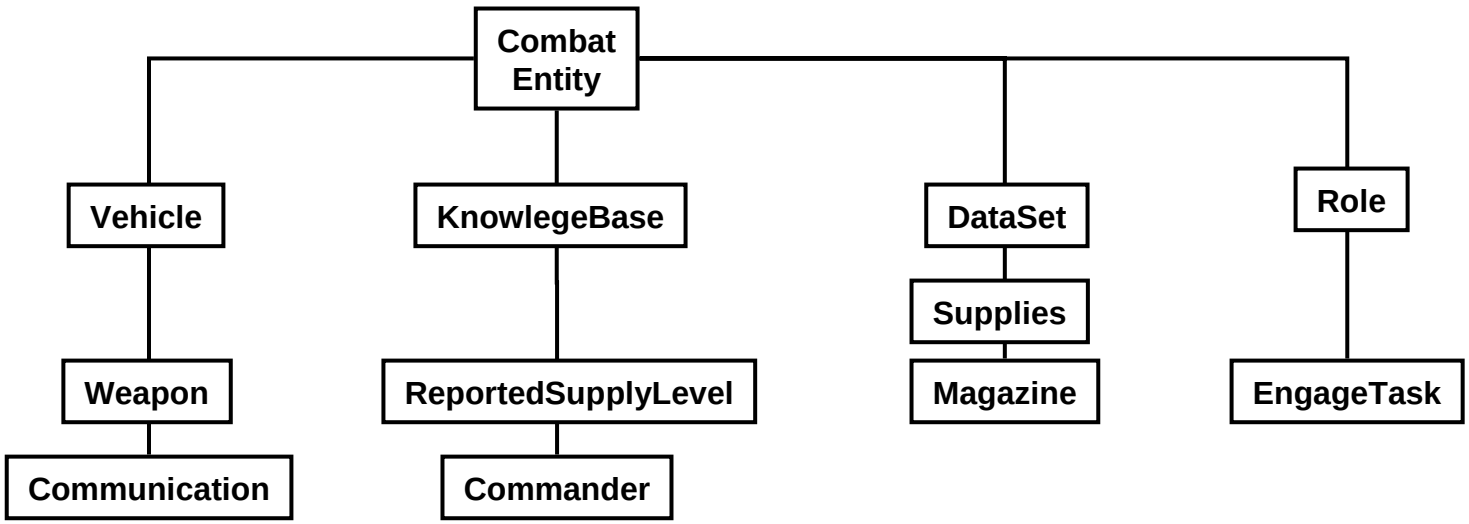
Internal Functionality

- Abstract Behavior Containers
- Open framework for Entity Data
- Open framework for Entity Perception



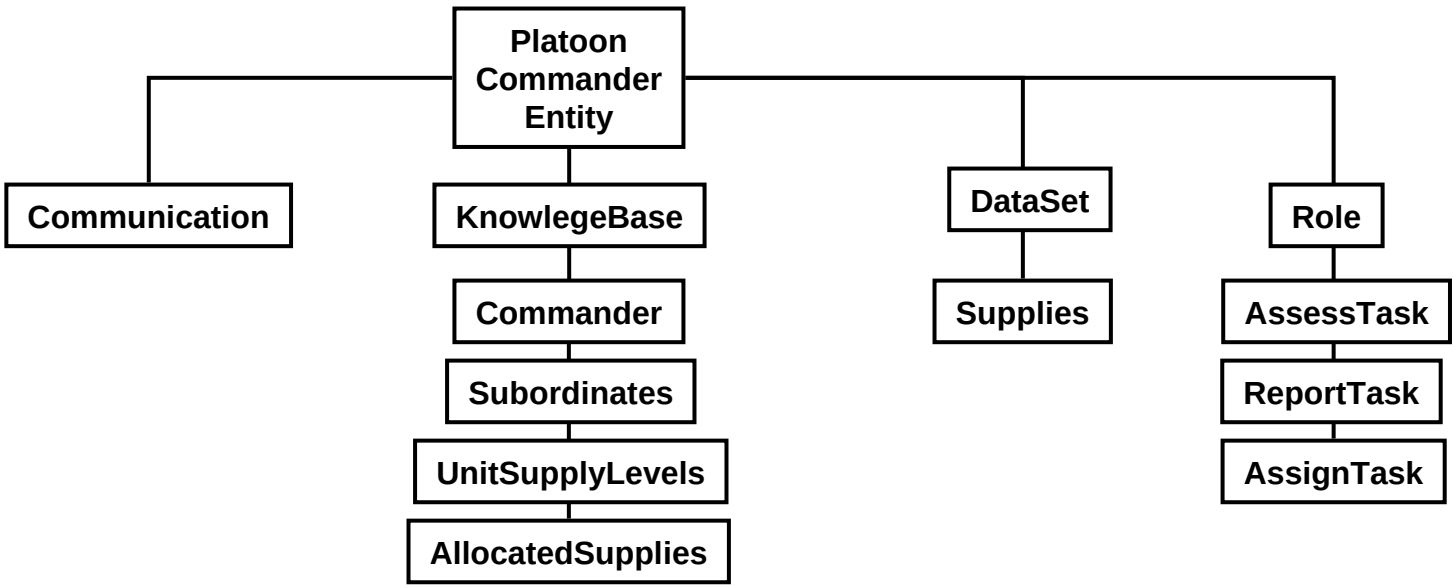
ATC Combat Entity

- Vehicle, Weapon, and Communication models establish performance
- Data managed for local supplies, and weapon magazines
- Knowledge maintained of Commander and supply level reported.
- EngageTask causes weapon fire and ammo decrement by weapon type.



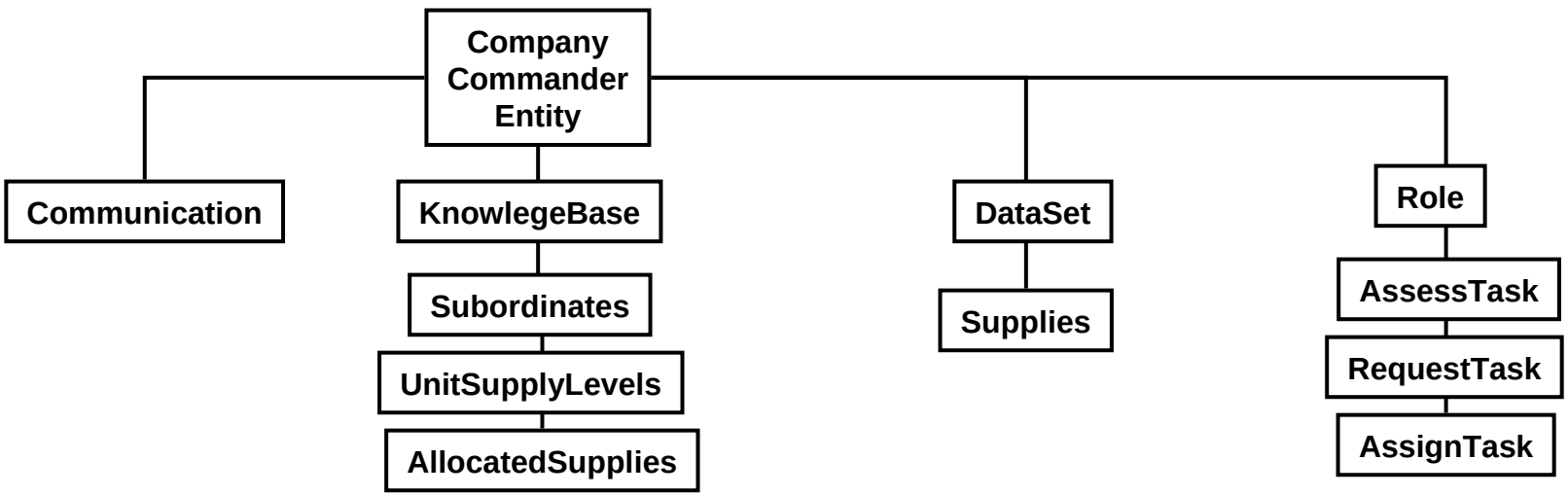
ATC Platoon Cmdr

- Receives updates from subordinates on supplies
- Maintains knowledge of every subordinates supply levels.
- Maintains aggregate unit supply level
- Reports the unit level supply to commander
- Assigns supply vehicles to subordinates
- Maintains knowledge of allocated supplies



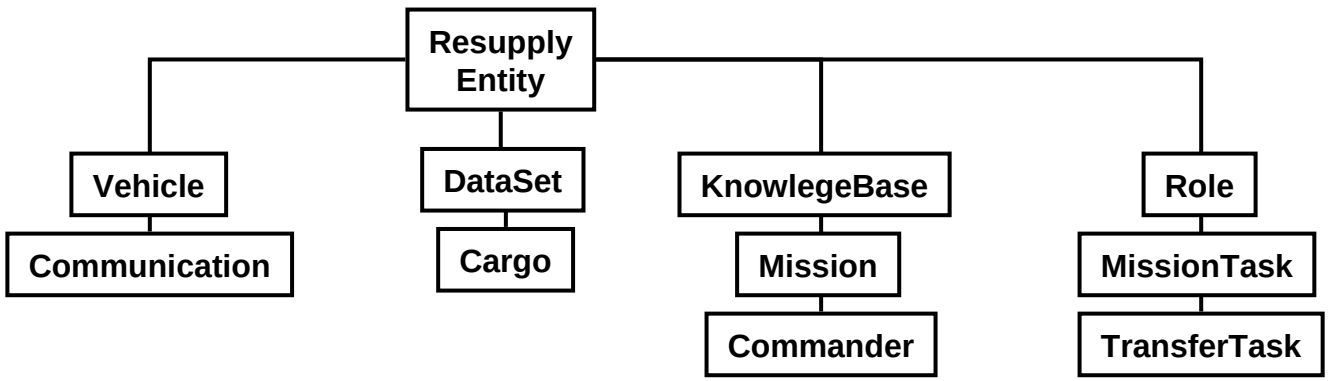
ATC Company Cmdr

- Receives updates from subordinates on supplies
- Maintains knowledge of every subordinates supply levels.
- Maintains aggregate unit supply level
- Requests Resupply from BSA
- Assigns supply vehicles to subordinates
- Maintains knowledge of allocated supplies



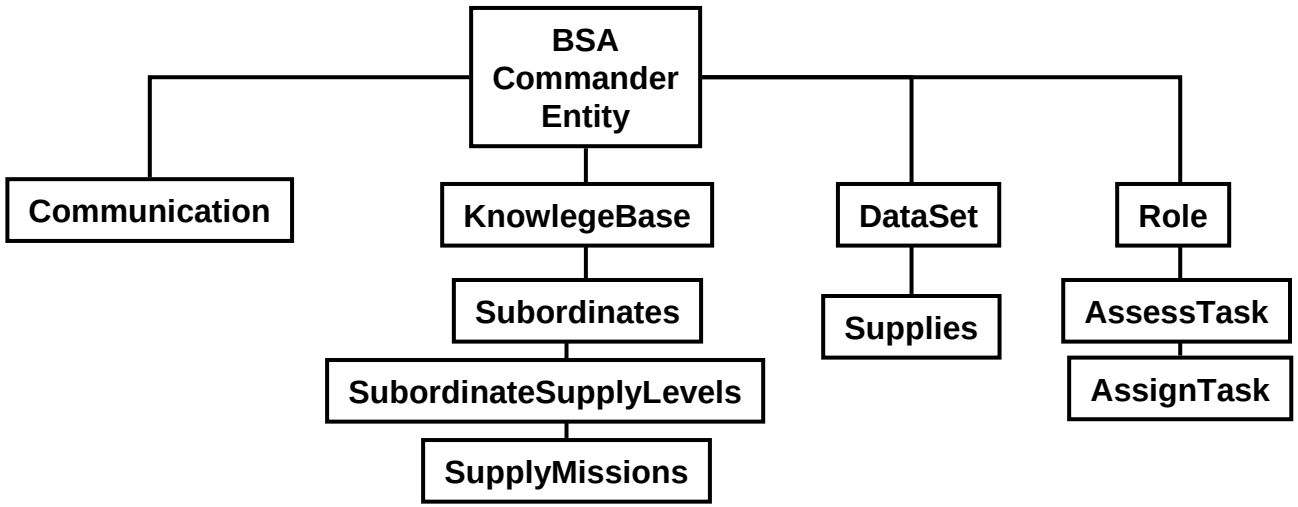
ATC Resupply Vehicle

- Receives missions from BSA Commander
- Maintains level of cargo
- Communicates with Commander and assigned mission POC
- Dynamically alters routes based on mission
- Transfers supplies to target vehicles.



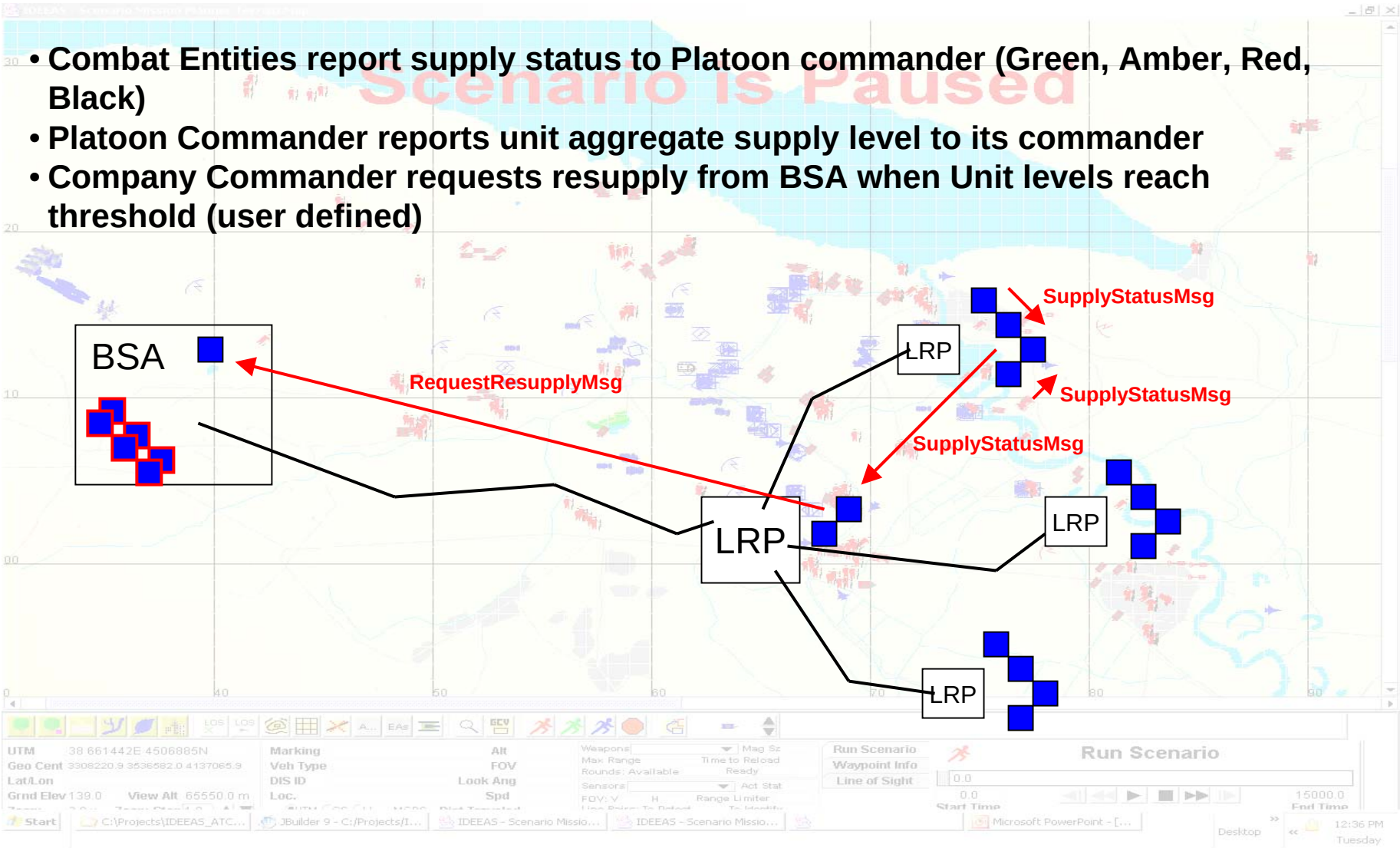
ATC
BSA Cmdr

- Maintains knowledge of every subordinate:
  - Supplies carried
  - Missions assigned
  - current status
- Assigns mission based on request, supply, availability.



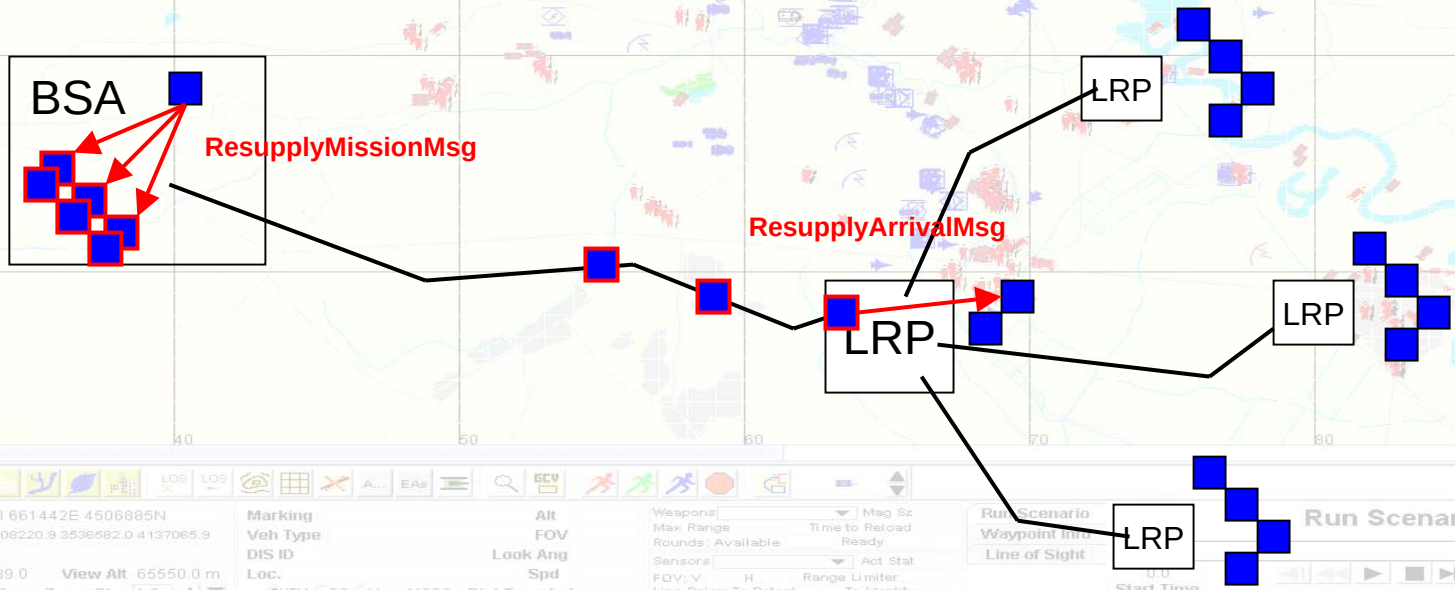
Model Overview Phase 1

- Combat Entities report supply status to Platoon commander (Green, Amber, Red, Black)
- Platoon Commander reports unit aggregate supply level to its commander
- Company Commander requests resupply from BSA when Unit levels reach threshold (user defined)



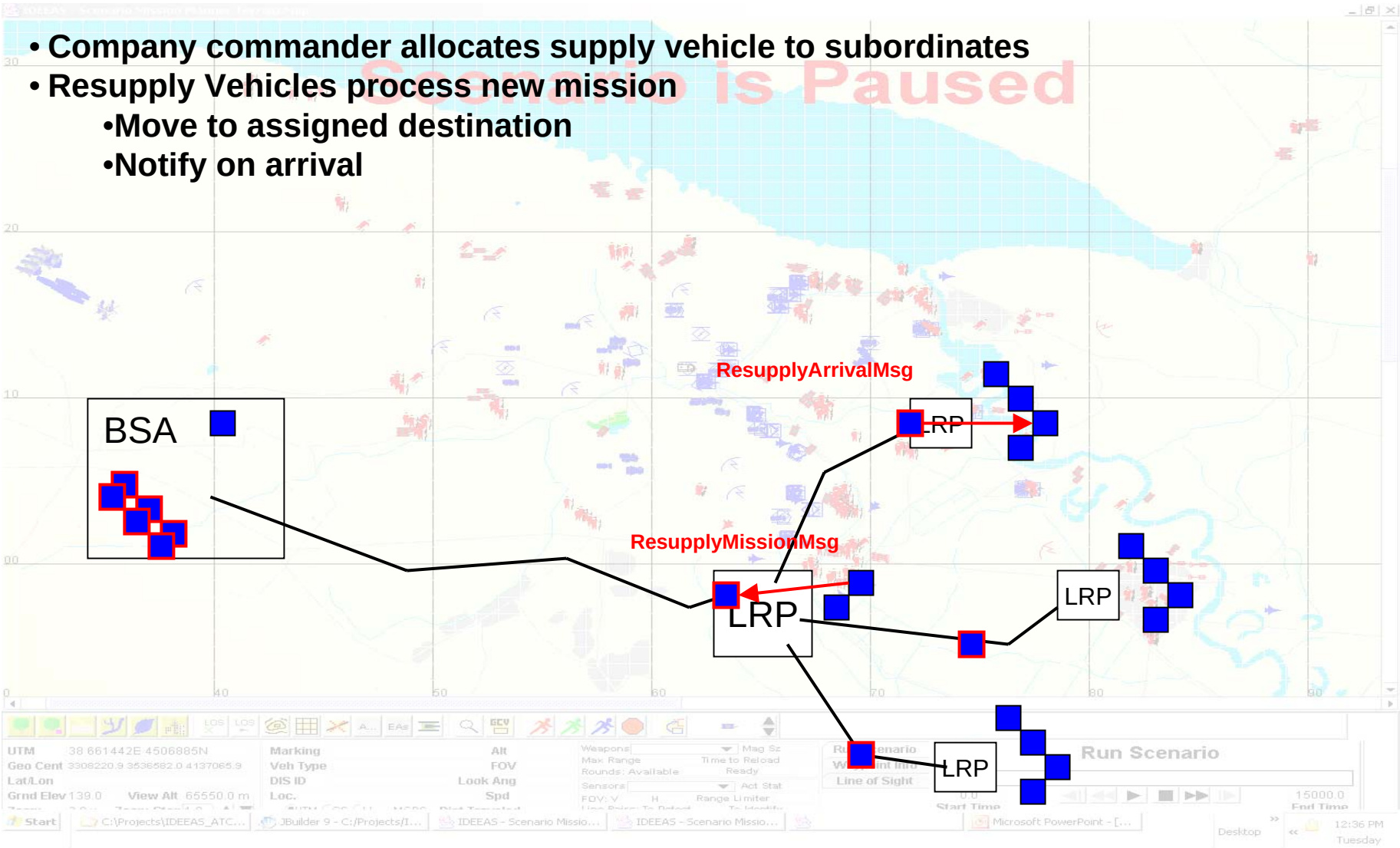
Model Overview Phase 2

- BSA Commander processes mission
  - Determines which vehicles carry requested supply item(s)
  - Determines number to dispatch to meet need.
- Assigns resupply mission to correct vehicles
- Resupply Vehicles process mission
  - Move to assigned destination
  - Notify of arrival, specify supply item(s)



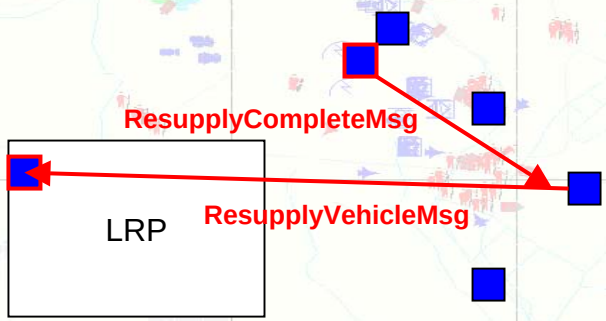
Model Overview
Phase 3

- Company commander allocates supply vehicle to subordinates
- Resupply Vehicles process new mission
  - Move to assigned destination
  - Notify on arrival



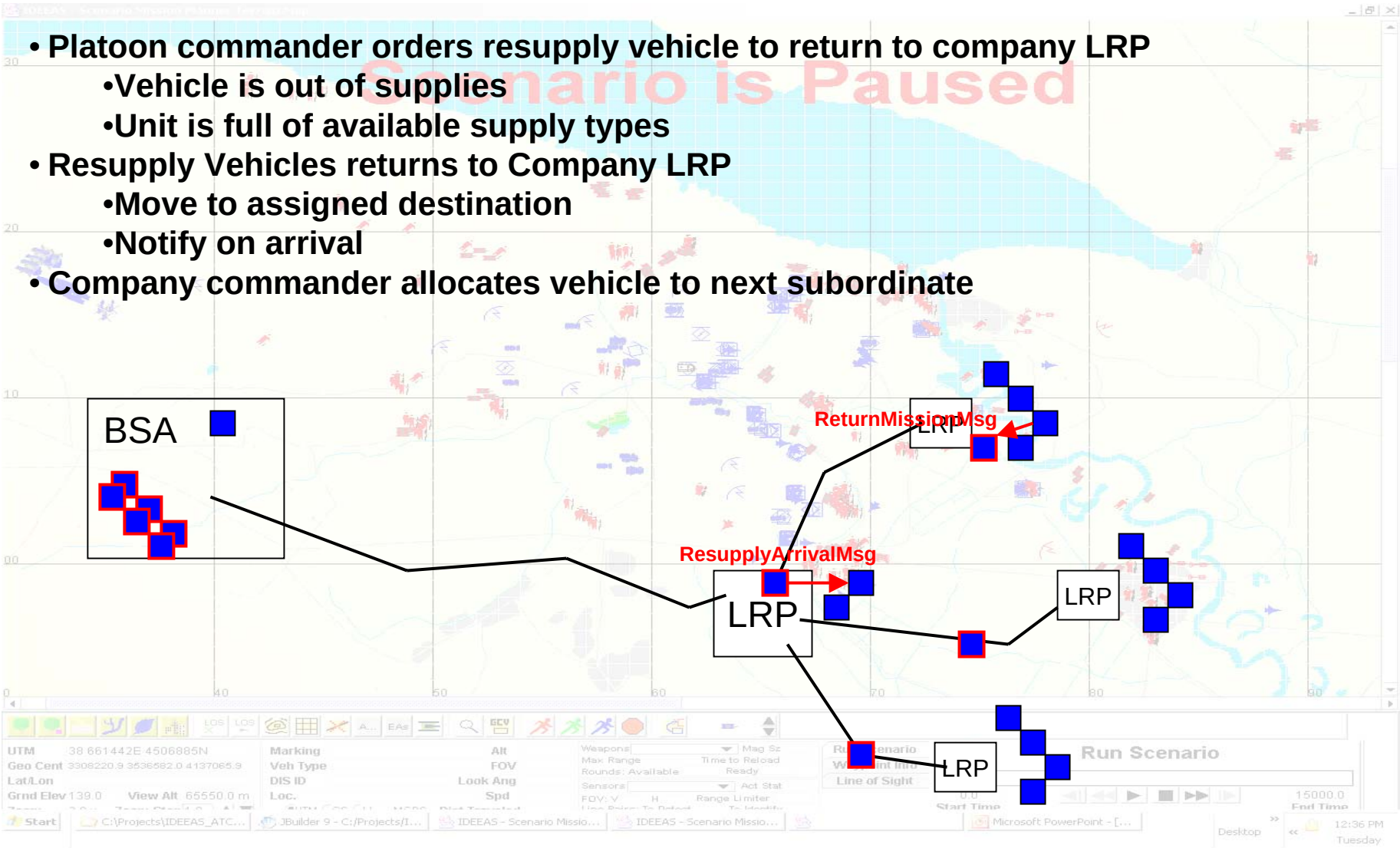
Model Overview
Phase 4

- Platoon commander allocates supply vehicle to subordinates
- Resupply Vehicles move to target vehicle
  - Transfer supplies to vehicle
- Terminates when:
  - Target full
  - Resupply Vehicle empty
  - Either vehicle destroyed
- Notifies commander when complete
- Commander directs to next subordinate



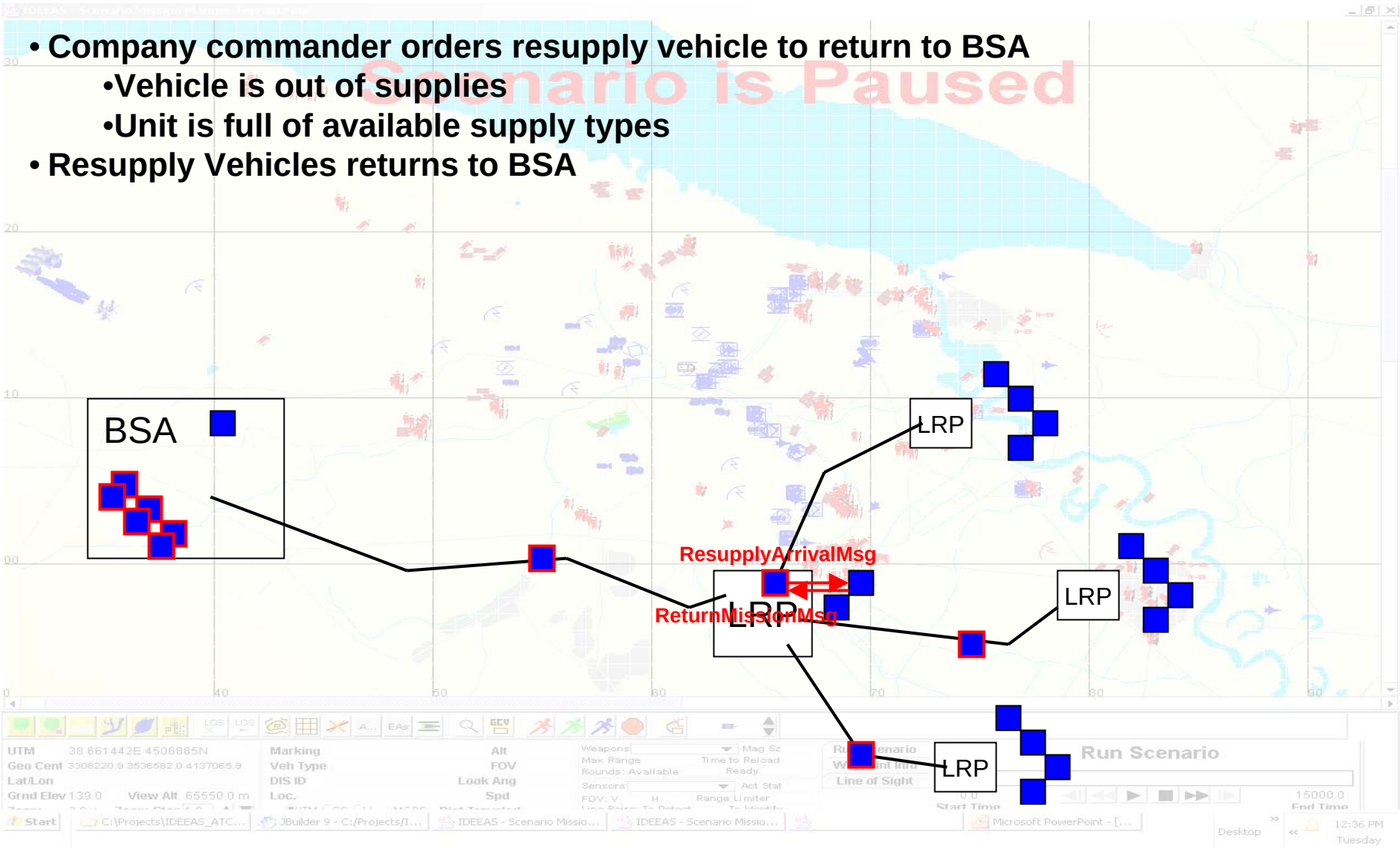
Model Overview Phase 5

- Platoon commander orders resupply vehicle to return to company LRP
  - Vehicle is out of supplies
  - Unit is full of available supply types
- Resupply Vehicles returns to Company LRP
  - Move to assigned destination
  - Notify on arrival
- Company commander allocates vehicle to next subordinate

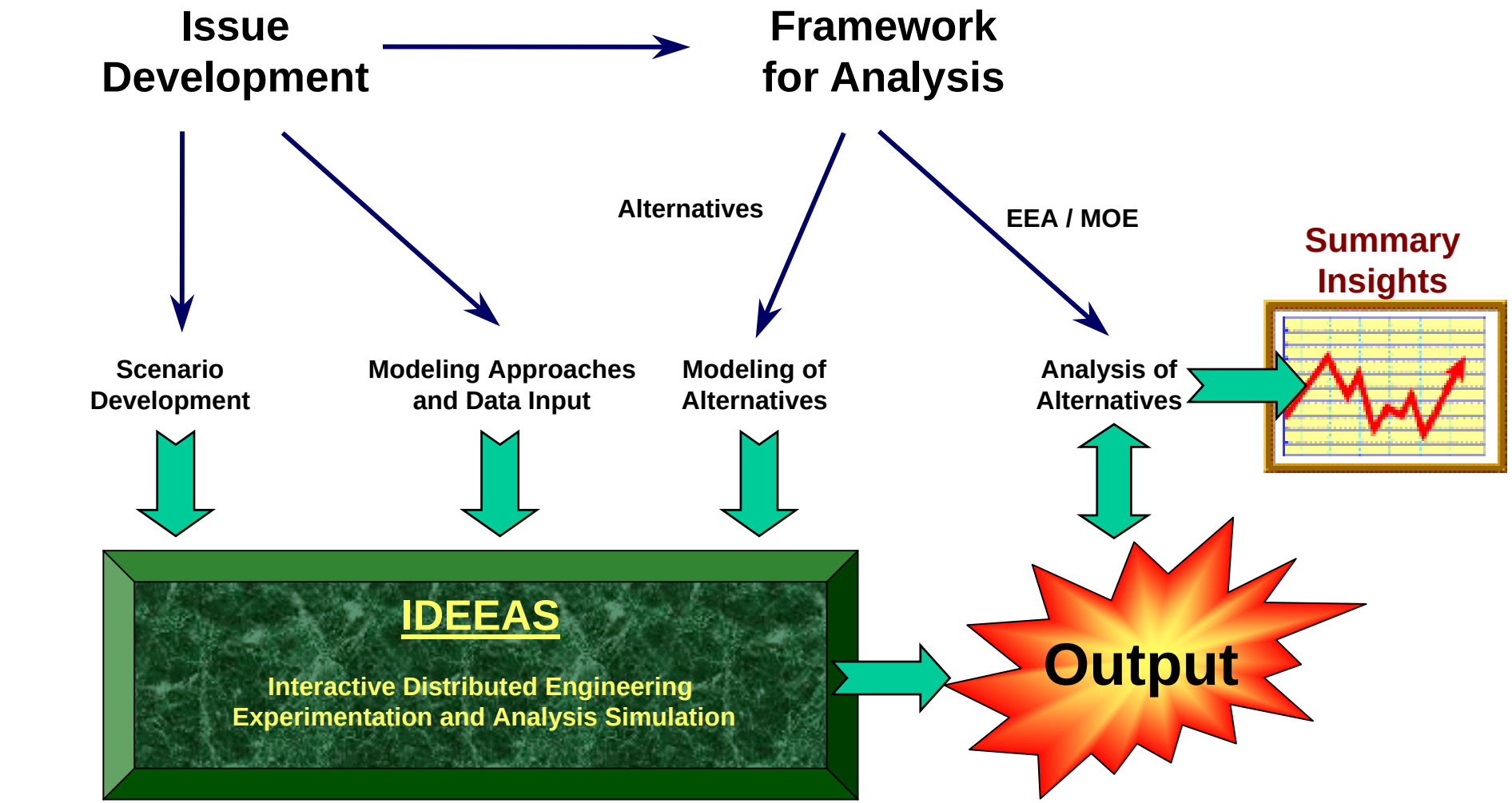


Model Overview
Phase 6

- Company commander orders resupply vehicle to return to BSA
  - Vehicle is out of supplies
  - Unit is full of available supply types
- Resupply Vehicles returns to BSA



Constructive Analysis Approach



ATC Analysis Approach

Issue:
Examine effects of conceptual AANT/WAASP logistic system on Combined Arms Battalion (+) Sustainment Operations

Framework for Analysis

Scenario:
Caspian Sea variation

Modeling:
Consumption, Command structure, and Sustainment functionality

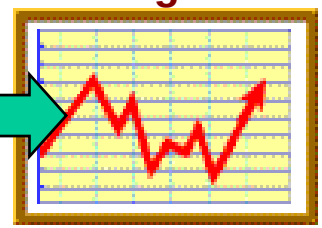
Alternatives

Alternatives:
Base FFTS Trucks
AANT/WAASP Combined

EEA / MOE

Analysis of Alternatives

Summary Insights



IDEEAS

Interactive Distributed Engineering Experimentation and Analysis Simulation

Output:
Fuel Consumed over time by entity
Ammo Consumed over time by entity
Resupply requests by time
Supplies Delivered by time
Delivery time, amount and duration by event
Total supplies consumed by type
Total supplies consumed by entity
Total supplied by type

Extension Possibilities

- Performance
  - Faster vehicles
  - Faster supply transfer
  - Larger vehicles
- TTP
  - Alternate delivery methods
  - Alternatives to supply requests
  - Variations on command structures

Componentized individual performance models enable open ended speculation

Contact Info

Ronald Saylor

AMRDEC

256 – 876 – 9036

Ronald.Saylor@us.army.mil